

Be it known that Malcolm L. Mitchell and Jeffery L. Warren,  
have invented a new and useful

System and Method for Implementing HACCP Process and Control  
at a Plurality of Food Service Establishments

5

Via the Internet

of which the following is a specification:

Field of the Inventions

10 The inventions described below relate to the field of food  
safety administration for controlling the hygiene or safety of  
Food Service Establishments.

Background of the Inventions

HACCP (Hazard Analysis Critical Control Point) is an  
internationally accepted technique used in the food service  
15 industry for preventing microbiological, chemical and physical  
contamination along the food supply chain. The HACCP technique  
does this by identifying potential hazards associated with a  
food, establishing critical control points in a food's  
production, setting critical limits for each control point,  
20 establishing procedures to monitor the critical control points,  
establishing corrective actions to be taken when monitoring  
shows that a critical limit has not been met, establishing  
procedures to verify that the system is working properly, and  
establishing effective recordkeeping to document the HACCP  
25 system.

Every restaurant that uses a HACCP system is required to maintain and control test data records. For example, a restaurant employee daily checks various critical control points in a food's production, including the food's temperature, storage temperature, pass or failure data, etc. The employee then fills out a paper checklist recording the data. These paper checklists are required for each food item as well as checklists for other potential hazards associated with food. Where a multitude of restaurants are affiliated with an organization, and each restaurant has its own checklists, an enormous amount of paperwork can be generated.

In addition to the mountains of paperwork generated by this manual procedure, the data is difficult if not impossible to process. Currently, operators do not know what the appropriate corrective actions are when a measurement is outside the critical limit. Furthermore, restaurant employees making the observations do not always follow standard procedure, often sitting in a back office filling out a checklist without actually observing the required checklist items.

## Summary

The HACCP system described below provides for a web-based architecture, making the system readily deployable in large organizations. The HACCP system administrator establishes the parameters of the HACCP system for the overall organization. The parameters, once defined, are thereafter visible at each remote facility within the organization. HACCP input operators make observations and enter data into a HACCP predetermined checklist. Data is entered into a computer device and the checklists presented on the screen completed electronically. When a critical limit is violated, corrective action prompts

appear directly on the screen of a personal digital assistant handheld computer (PDA) for the input operator to follow. The HACCP software program, parameters, and data results are stored in a database server. Changes to checklist forms, critical  
5 limits, and corrective actions instantly propagate company-wide.

The direct temperature input from the integrated probe minimizes error. An integrated data reader embedded on the probe reads coin-sized metal tags, each with a unique I.D. These tags can be used to ensure that users make observations in  
10 the required location. In addition, the data reader can download information from data loggers placed throughout the facility, as well as any critical control point in a food's production cycle.

The system manages complex multi-step processes such as  
15 cooling by providing for checklists within checklists. Alarms, elapsed time timers, and different critical limits and corrective actions at each point manage and document multi-step processes. Real time corrective action prompts appear when potential problems are detected.

## 20 Brief Description of the Drawings

Figure 1 shows an overview of the system components.

Figures 2a through 2x illustrate sample screen shots of the user interface for the HACCP administrator.

Figure 3 shows one implementation of the system described  
25 in Figure 1.

Figure 4 shows one embodiment for a temperature probe with embedded data reader.

### Detailed Description of the Inventions

Figure 1 shows an overview of the HACCP system, comprising a HACCP system administrator 1, restaurant managers 2 and HACCP input operators or "users" 3. The HACCP system administrator, in concert with the organization's HACCP goals, establishes the parameters of the HACCP system for the overall organization. The HACCP system administrator accomplishes the task of defining the system parameters by way of a personal computer or other computing device with access to the Internet. An elaborate user interface is provided for initially setting up and managing the rules and configuration of the HACCP system. The program and parameters are stored in a database server 4, either resident in the HACCP administrator computer or elsewhere at a remote database server accessible via the Internet. The parameters, once defined, are thereafter visible at each remote facility within the organization. The HACCP administrator may make changes to the parameters at any time when a change or revision is required to be implemented throughout the organization. The HACCP administrator may program the parameters from any location: at corporate headquarters, at a remote facility, even from a laptop computer anywhere in the world. Four main parameters are used: locations, items, users, and checklists.

First, the HACCP administrator creates a list of locations where HACCP inputs and measurements will be required. "Location" generally refers to a specific location (such as a restaurant) or a group of locations (such as a region). As such, locations are defined hierarchically. "Location" may also refer to critical control points in a particular restaurant, such as the kitchen, buffet or food cart. Location details, such as name and address, are entered. Finally, location contact information, such as a restaurant manager's name,

telephone and fax numbers and email address are added. The information is stored in the database server 4 where it is maintained until it is subsequently edited, deleted or new locations added.

5           The HACCP administrator then creates a list of items where HACCP inputs and measurements will be required. An "item" may be a menu item, such as a hamburger, a piece of equipment, such as a grill, or a general food safety process, such as use of protective gear. Item details are then entered, such as name  
10 (hamburger) and description (all hamburgers). Item "parents" may also be entered, such as "beef." Processes associated with the item are entered as applicable, such as cooking, reheating, freezing, cold handling, or hot handling. Process measurements, such as temperatures, may be added, edited or deleted.  
15 Corrective actions may also be added to dictate actions to be taken in the event of a violation, such as a time-out violation or out of specification temperature. The item list may be filtered based upon available location menu items, for example, if a particular food item is not available at all of the  
20 organization's locations. Items can thereafter edited, deleted or added.

          The HACCP administrator also creates a list of users. User details, such as user's name, telephone, and email address, Internet user id, and web password or personal identification  
25 number (PIN) are entered. Some users will be able to access computer input devices and those users will have a special password allowing them access to the input device. Information for existing users can be edited, such as a change to telephone number or email address, Internet access information and input  
30 device access information. The list of users is maintained until it is subsequently edited.

Finally, the HACCP administrator creates the checklists (or assigns predetermined checklists). Data is entered for each checklist, such as its category, description, the time the checklist is to be performed, and the checklist item's execution cycle, such as daily, weekly, or other. Checklist categories include such duties as cooking, cooling, cold holding, hot holding, reheating, etc. Checklist activities can be scheduled or unscheduled. Checklist categories can contain one or more sub-checklists. A provision may be added so that notes can also be entered into the checklists. A list of checklist items may be programmed in advance and selected by the HACCP administrator to add to the checklist.

Several checklist item types are used in the system, such as text, choice, measurement, or process. If the checklist item type is a "text," then the operator adds checklist item details as text entry. If the checklist item type is a "choice," then the operator selects from two or more choices presented on the handheld computer. If the "wrong" answer is selected, the operator is presented with appropriate corrective actions defined by the HACCP administrator. If the checklist item type is a "measurement," then the operator inputs a measured value, such as temperature, either manually or through the use of the integrated temperature probe. If the measured value is out of specification, then the operator is presented with appropriate corrective actions. A corrective action might be to discard food or contact the manager. If the checklist item type is a "process," then the item inherits process rules. For example, a process rule might exist for the cooking of any ground beef product to a temperature of 150 degrees Fahrenheit. If a process type checklist item was "Check the temperature of a hamburger," this item would automatically inherit a cooking temperature rule of 150 degrees Fahrenheit by virtue of being a

ground beef product. Checklists may be reordered in any order desirable by the HACCP administrator. The checklists are maintained until they are subsequently edited.

5 The restaurant managers supervise the food service workers and make additional changes and recommendations to checklists established at the corporate level by the system administrator. Restaurant managers are restricted in the changes that they can make to the overall system checklists. For example, it is likely that the HACCP administrator would configure the software  
10 to allow the restaurant manager to access the user information to update employee information, add and delete employees as necessary, and also reflect special access to different procedures depending on employee promotions and shift changes. It is not likely that the HACCP administrator would configure  
15 the software to allow the restaurant manager to access parameters relative to critical control points, such as making a substantive change to the checklist procedures.

Once the HACCP parameters have been entered by the HACCP system administrator and stored in the database server 4, users  
20 will start to enter data into the system. The user will enter data into a data acquisition system. The data entered into the data acquisition system will be uploaded to the database via the Internet when synced with the restaurant manager's personal computer.

25 HACCP input operators are food service workers tasked with the HACCP function of taking readings and entering data into a HACCP predetermined checklist. Data is entered into a data acquisition system and the checklists presented on the screen completed electronically. In the preferred embodiment, the data  
30 acquisition system includes a personal digital assistant (PDA) or other hand held computer device. However, a laptop or other

personal computer could be used. The user follows a series of beeps and prompts to follow the checklist.

The data acquisition system also includes various probes. Primarily, a temperature probe is provided for use in making temperature measurements, which are the predominant parameter of HACCP. The temperature probe is ideally connected directly to the PDA for ease in taking measurements and logging the information directly into the PDA to avoid user error in inputting data.

Small tags, each with a unique digital ID are also employed. By affixing ID tags such as the iButton® at various locations in a facility it is possible to determine the exact location of the operator when a check was performed. For example, ID tags can be attached to freezer walls, lavatory walls, or any place where the user will have to make a reading. This insures that the operators are actually where they are supposed to be when performing checks and are not simply sitting in a back office filling out a checklist. ID tags may also have data logging capability. Data logging ID tags, such as the ThermoChron®, can be mounted in refrigerators, freezers, or go wherever thermally vulnerable products go, monitoring time and temperature and storing the data. Data loggers easily attach to a container, recording time and temperature during transport and storage. By logging the thermal experience of temperature-sensitive material, HACCP administrators can pinpoint responsibility for spoilage and take corrective action. The data logger reader, or ID tag reader, is built into the temperature probe and reads the unique ID number from iButton® tags or captures the temperature data from the ThermoChron® data logger tags. The temperature probe with built-in tag reader can



be attached to the PDA, the user's computer, or any other device for ease of retrieving the information.

5 The series of steps and figures described below reflect one of the many embodiments for implementing a HACCP system via the Internet. Many other screens and procedures may be implemented, depending on the organization's HACCP goals. The user inputs reflect a system already set up by the HACCP administrator, as previously described.

10 In general, an operator pushes a single button to hot sync the PDA, and in just a few seconds, the most current HACCP data for that restaurant is automatically downloaded via the Internet. Process rules, checklists, food items, equipment lists, critical limits, corrective actions and more are all quickly loaded onto the PDA. Thereafter, the operator follows  
15 prompts – flashing icons and audible alarms that alert the operator when it is time to perform checks. A temperature probe captures temperature data directly to the PDA. A built-in tag reader verifies that operators are actually where they are supposed to be when performing checks. Operators document that  
20 they actually are where they are supposed to be when performing checklists by touching coin sized metal tags. At the end of the day, an operator pushes the button again, and all the data is sent via the Internet to a central database. Reports can be viewed by management anywhere via the Internet.

## 25 Login

When the application on the PDA is first launched, the user will be presented with a list of locations that have currently been defined for use by this PDA. As shown in Figure 2a, the users of this input device will be entering data relative to the  
30 kitchen, buffet and food cart site locations. Each location in

the list can have its own unique set of users, checklists, and menu and equipment items.

After selecting a location, the list of users authorized to use the PDA at that location will be presented to the user, as shown in Figure 2b. After selecting a user and keying in the user's personal identification number (PIN) (see Figure 2c), the main application screen is available (see Figure 2d).

#### Location Administration by Restaurant Manager

PDA's can be difficult to uniquely identify, and can break and need to be replaced. Therefore, the restaurant manager can program "locations" directly into the PDA rather than requiring the intervention of the HACCP system administrator. Pressing the Admin button on the Select Location screen (Figure 2e) directs the user to the Location Administration screen (Figure 2f). From the Location Administration screen (Figure 2f), locations to associate with this PDA can be added, deleted, and edited. Figure 2g shows an example of defining a new location for this PDA. Once the new location name is entered, the PDA can download the associated items, users and checklist parameters from the database server 4.

#### Checklist Execution

Whenever a checklist is scheduled for execution, and a user is logged into the PDA, the PDA application will automatically wake itself up, emit an audible alarm, and flash the icon on the main application screen to indicate the checklists that a user must address and complete in order to comply with the HACCP procedure governed by the checklist. Figure 2h indicates that one or more checklists in the Checklist, Hot Hold, and Cold Hold categories need attention.

Checklists may govern scheduled or unscheduled checklists. Unscheduled checklists are used for storing infrequently used checks, or ones that only need to be executed as part of standard operating procedures under particular circumstances (for example, only when a particular piece of equipment is in use or when a particular evolution is in progress). Each of the checklist categories shown on the main screen can contain one or more checklists. Clicking on an icon from the main screen (Figure 2h) shows the sub-checklists for that category.

Figure 2i shows a list of checklists in the "Checklist" category for a particular PDA. In this case, the bullet next to the "Daily Sanitation a.m." checklist indicates that that checklist is currently "alarming" and needs to be executed. A checklist is executed by simply selecting it from the list.

Each question on a checklist will be presented to the user one at a time. Figure 2j shows a sample question from the "Daily Sanitation a.m." checklist. In this particular case, the question has a possible response of yes or no. There can be occasions when the HACCP system administrator wants to provide additional information regarding the policy that should be used for determining the proper response to the question. The question shown in Figure 2j has a policy associated with it that can be viewed by clicking on the "Policy" button in the upper right corner of the screen. This will present the user with the Policy screen as shown in Figure 2k.

"Choice" questions can have up to four possible responses in this example. Figure 2l shows a question from the Daily Sanitation a.m. checklist that has four possible responses. Each choice can optionally have its own set of corrective actions associated with it. These corrective actions are presented to the user to indicate that the response that was

selected requires immediate action to be taken, and provides a mechanism for including with the report the corrective action that was taken. Figure 2m below shows the set of corrective actions that are presented to the user if the "Often" answer is selected to the question posed in Figure 2l.

The user can also enter in notes to be associated with the answer to individual questions on a checklist. Figure 2n shows a sample notes screen that could be entered by clicking on the Notes button in Figure 2l.

Figure 2o shows an example of a "text" question. A text question is one that does not have a multiple-choice set of answers to select, but instead requests that a piece of text be entered as a response. Note also that all questions within a checklist have an option of selecting the "Not Observed" button. This allows questions to be skipped that are either currently irrelevant, or cannot be answered for other reasons, such as an observation for a piece of equipment that is down for maintenance.

#### Process Execution

In addition to executing checklists as a form of predefined questions, the PDA application supports monitoring processes that have defined critical limits for multiple-step processes. The rules for a particular process and item are configured by the HACCP system administrator. To execute a process, after selecting the category for the process from the main screen, click on the "New Check" button as shown on Figure 2p. In this example, the list of items configured for this location that can be cooled are presented to the user for selection, as shown in Figure 2q. After selecting the item, the user will be presented with a temperature measurement screen for the first step in the

process (Figure 2r). Note that the critical limits for this step will be displayed below the real-time temperature indicator.

After the first step for a process has been executed, subsequent steps in the process can be executed by reselecting the item. In the example above, from the main screen, the Cooling category would be selected, and the Poultry item that has already started to cool will be available from the list as shown in Figure 2s. Selecting this item from the list will present the temperature measurement screen for the second step in the process, as shown in Figure 2t. Note that the critical limits that are displayed were entered by the HACCP system administrator as appropriate for this step in the process. If a value is entered that does not meet the critical limits, a set of corrective actions will be presented as shown in Figure 2u. The process is completed once all of the steps have been performed.

### Reviewing Checklists

After a checklist has been executed, the results are stored in memory until they are purged or written-over. The answers for a particular checklist can be reviewed and modified anytime before they are purged or written-over. To start this process, the user clicks on the Report button from the main screen as shown in Figure 2v. This feature may be disallowed by the system administrator.

The list of checklists that have been executed on this PDA will be shown in a list as shown in Figure 2w. By selecting a checklist from the list, a summary of each question and the answer that was provided will be shown as demonstrated in Figure 2x. Selecting one of the checklist items will present the

question to the user again so that the details of the answer (including notes and corrective actions) can be reviewed and/or modified.

At the completion of all of the measurements to be taken and other reporting done, the user uploads the data from the PDA to the database server where it is stored for later data analysis. The HACCP administrator or other person desiring to evaluate the data can review the data, search for problems, and take corrective action.

Figure 3 shows an overview of one embodiment of the HACCP system described above, comprising a HACCP administrator computer 5, a system server 6, a database server 7, at least one Restaurant computer 8, and at least one personal digital assistant (PDA) 9.

The HACCP administrator 5 is a client who communicates with the system server 6 via the Internet. The HACCP administrator client connects with the system server from any personal computer or other computer via a web browser.

The system server 6 provides various functions, including a web-based user interface that provides the user access to the HACCP system without requiring individual software installations on each restaurant computer 8. Wizard-based interfaces are provided using a standard web browser on any personal computer to configure all aspects of the HACCP system across even the largest organization. The Web-based software can be configured to add company logo information according to the company's preference. The system server 6 components are industry standard commercial off the shelf applications such as Microsoft IIS, Microsoft SQL server, and Crystal Reports. Specific hardware requirements are dependent upon these applications and

the size of the organization. The server consists of web pages and services running under the industry standard Microsoft IIS web server. The server communicates with web browsers and the PDAs using standard http protocols to avoid issues associated  
5 with corporate firewalls.

The HACCP software works with other applications so that reports can be automatically e-mailed. Custom analysis can be performed on the IQ HACCP with common applications such as Crystal Reports <sup>TM</sup> and Business Objects <sup>TM</sup>.

10 The HACCP software can easily add or modify the HACCP checklists, critical limits, or corrective actions. When the HACCP system administrator revises any of the established parameters, the change is communicated instantly across the web to the entire organization, thus appearing at each restaurant  
15 location upon the next synchronization.

The central database server 7 acts as the central repository of information for the entire HACCP system. Microsoft's SQL Server or other database platforms will be used for the database server. All access to the database will be  
20 exposed as object invocations and methods in order to encapsulate all of the database specific functionality. The central database server and the system server may be combined or separate, and in one location or different locations.

The restaurant computers 8 are clients who communicate with  
25 the system server 6 via the Internet. The restaurant PC software is based on the Microsoft.NET platform. For some PDAs synchronization software that comes with the PDA must be loaded onto the restaurant PCs to integrate with the IQ HACCP system on the PDA. For example, HotSync manager is a Windows based

application delivered with Palm Desktop that provides the synchronization capabilities required for PDA operation.

The HACCP system includes a custom conduit, when required, for the HotSync manager that will be used to communicate the data between the HACCP application on the PDA and the central database. Since this software is a conduit of the HotSync manager, it will have to be installed on each machine that is used for synchronizing a PDA. Not all PDA operating systems will require the conduit. In order to assist with the installation, this software will be packaged in a way to allow it to be distributed to clients from a website. Web services are used by the custom conduit for communication. These services run on the web server and provide XML interfaces to transfer information to and from the database.

The PDA device 9 can be any PDA such as the Palm, Dell Axim, Hewlett-Packard/Compaq iPaq, etc. The IQ HACCP software is loaded on the PDAs, but it can be downloaded off the Internet. The PDA software will be compliant with nearly every Palm OS and PocketPC based PDA on the market. The temperature probe is also designed to be compatible with nearly all PDAs as well. The cable assembly which connects the temperature probe to the PDA can be changed to accommodate the connector requirements of different PDAs.

Figure 4 shows a temperature probe 10, provided for attachment to the user's PDA. The temperature probe 10 is a universal temperature probe that fits many different types of PDAs. The temperature data probe attaches directly to the serial port of a PDA, tablet PC, laptop or desktop PC. The stainless steel tip 11 can be inserted directly into food products. The temperature probe allows direct temperature input into the PDA, which reduces human-related error due to manual



temperature input. Embedded within the temperature probe is a  
ID tag reader interface 12 for reading the data from ID tags and  
data loggers mounted throughout the HACCP system. The ID tag  
reader feeds the data from the ID tags and data loggers directly  
5 into the PDA.

In a franchised food service organization comprising a  
franchisor and a plurality of franchisees, the method of  
implementing HACCP process and control can further require that  
the database be controlled by the franchisor (serving the HACCP  
10 administrator function) and that the data acquisition systems be  
purchased, controlled, and maintained by the franchisees. This  
also applies to organizations where each food service  
establishment within the organization has compartmentalized  
budgets, and wherein each food service establishment may be  
15 tasked with purchase control and maintenance of the data  
acquisition systems in order to address these compartmentalized  
budgets. Purchase, control and maintenance of the data  
acquisition systems, including PDA's, probes and applicable  
software and/or software licenses is thereby distributed over a  
20 number of discreet budgets or organizations.

Thus, while the preferred embodiments of the devices and  
methods have been described in reference to the environment in  
which they were developed, they are merely illustrative of the  
principles of the inventions. Other embodiments and  
25 configurations may be devised without departing from the spirit  
of the inventions and the scope of the appended claims.